



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/576,134	07/13/2007	Enrique V. Barrera	I1321-P074WOUS	5500
61/060	7590	04/26/2010		
WINSTEAD PC			EXAMINER	
P.O. BOX 50784			CHOI, PETER Y	
DALLAS, TX 75201			ART UNIT	PAPER NUMBER
			1786	
MAIL DATE	DELIVERY MODE			
04/26/2010	PAPER			

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/576,134	Applicant(s) BARRERA ET AL.
	Examiner PETER Y. CHOI	Art Unit 1786

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If no period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 27 January 2010.

2a) This action is FINAL. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 41-69, 71 and 72 is/are pending in the application.

4a) Of the above claim(s) 50-67, 71 and 72 is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 41-49, 68 and 69 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on 17 April 2006 is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) Notice of References Cited (PTO-892)
 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
 3) Information Disclosure Statement(s) (PTO/SB/08)
 Paper No(s)/Mail Date _____

4) Interview Summary (PTO-413)
 Paper No(s)/Mail Date _____

5) Notice of Informal Patent Application
 6) Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102/103

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 41, 42, 45, and 47 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over US Pub. No. 2005/0191490 to Ton-That.

Regarding claims 41, 42, 45, and 47, Ton-That teaches a composite material, comprising carbon nanotubes, a fiber reinforcement material, and a polymer, wherein the carbon nanotubes chemically bind the fiber reinforcement material with the polymer (paragraphs 0002-0022, 0025-0030, 0034-0042, 0050-0056, 0064, 0075, 0077, 0078). Additionally, it would have been obvious to one of ordinary skill in the reinforcing composite material art at the time the invention was made to form the reinforcing composite of the prior art, wherein the composite comprises glass fiber reinforcement material, as the prior art teaches the suitability of glass fibers in the

reinforcing composite, and including glass fibers would have been obvious based on the desired tensile and flexural strength of composite suitable for the intended application.

Regarding claim 42, the carbon nanotubes are silane-functionalized (paragraph 0029).

Regarding claim 45, the fiber reinforcement comprises glass fibers (paragraphs 0077, 0078).

Regarding claim 47, the polymer is an epoxy (paragraphs 0002-0022, 0025-0030, 0034-0042, 0050-0056, 0064, 0075, 0077, 0078).

Claim Rejections - 35 USC § 103

3. Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ton-That, as applied to claims 41, 42, 45, and 47 above, in view of “Single-Walled Carbon Nanotube-Polymer Composites: Strength and Weakness” to Ajayan.

Regarding claim 43, the prior art does not appear to teach that the carbon nanotubes are single-walled nanotubes. Since the prior art is silent as to the type of nanotubes, it would have been necessary and therefore obvious to look to the prior art for conventional nanotubes suitable for use in composites. Ajayan provides this conventional teaching, showing that it was known in the composite art to form composites comprises carbon nanotube and epoxy composites, wherein the carbon nanotubes comprise single-walled nanotubes (Ajayan, pages 750-753). Ajayan teaches that various properties are known and attributed to carbon nanotubes, specifically single-walled carbon nanotubes. Additionally, Ajayan teaches that including single-walled carbon nanotubes in nanotube-epoxy composites increases the toughness of the composites by absorbing energy, strength and flexibility. It would have been obvious to one of ordinary skill in the

composite art at the time the invention was made to form the composite of the prior art, wherein the carbon nanotubes comprise single-walled carbon nanotubes, as taught by Ajayan, motivated by the desire of forming a conventional nanotube-epoxy composite comprising nanotubes known in the art as predictably suitable for use in such composites to increase the toughness of the composites by absorbing energy, strength and flexibility.

4. Claims 44 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ton-That, as applied to claims 41, 42, 45, and 47 above, in view of USPN 6,270,897 to Flautt.

Regarding claims 44 and 46, the prior art does not appear to teach that the fiber reinforcement is silane-functionalized and that the glass fibers have been resized with an organosilane species. However, Flautt is classified in the same field in the art as Ton-That, and teaches a glass fiber reinforced composite material comprising glass fibers and an epoxy matrix (Flautt, column 1 line 7 to column 5 line 10, claims 1-14). Flautt teaches that sizing the glass fibers with an organosilane reduces interfilament abrasion, and improves compatibility of the fibers with the epoxy matrix material of the composite structure. It would have been obvious to one of ordinary skill in the composite art at the time the invention was made to form the composite material of the prior art, wherein the glass fibers are sized with an organosilane, as taught by Flautt, as Flautt and Ton-That are classified in the same field in the art, and motivated by the desire of forming a conventional composite material wherein the interfilament abrasion of the glass fibers is reduced, the compatibility of the fibers with the epoxy matrix material is improved, and the physical properties of the composite material is enhanced.

5. Claims 48 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ton-That, as applied to claims 41, 42, 45, and 47 above, in view of USPN 3,312,569 to Philipps.

Regarding claims 48 and 49, the prior art does not appear to teach that the glass fibers are in a form of woven sheets, and that the woven sheets are stacked together with the silane-functionalized carbon nanotubes and the polymer between them. Since the prior art does not appear to teach in what form the glass fibers are employed, it would have been necessary and therefore obvious to look to the prior art for conventional forms of glass fibers in composites. Philipps is classified in the same field in the art as the prior art, and teaches that it was known in the reinforced composite art to form a glass fiber reinforced composite comprising glass fibers and an epoxy resin, wherein the glass fibers are in the form of woven mats (Philipps, column 1 line 14 to column 4 line 35, column 7 line 15 to column 8 line 68). It would have been obvious to one of ordinary skill in the reinforced composite art at the time the invention was made to form the reinforced composite of the prior art, wherein the glass fibers are in the form of woven sheets, as taught by Philipps, as Philipps and Ton-That are classified in the same field in the art, and motivated by the desire of forming a conventional reinforced composite comprising glass fibers in forms known in the art as being predictably suitable for use in reinforced composites, based on the strength and flexural characteristics suitable for the intended application, as woven sheets will predictably comprise increased dimensional stability.

Regarding claim 49, although the prior art does not appear to specifically teach that the carbon nanotubes and the polymer are between the stacked sheets, it naturally flows from the prior art that the woven glass fibers are employed in an epoxy resin composite, and uniformly dispersing the constituents of the composite, such as the nanotubes, glass fibers, and epoxy resin,

in the composite enhances the uniformity of the physical and chemical characteristics of the composite. Therefore, it would have been obvious to one of ordinary skill in the reinforced composite art at the time the invention was made to form the reinforced composite of the prior art, wherein the carbon nanotubes and polymer are between the woven sheets, motivated by the desire of forming a conventional reinforced composite comprising uniform physical and chemical characteristics, such that the composite comprises the desired strength, flexural characteristics, and dimensional stability suitable for the intended application.

6. Claims 68 and 69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ton-That, as applied to claims 41, 42, 45, and 47 above, in view of “Chemical Functionalization of Carbon Nanotubes Through an Organosilane” to Velasco-Santos.

Regarding claims 68 and 69, the prior art does not appear to teach the specific formula of the silane-functionalized carbon nanotubes. Since the prior art is silent as to the specific formula of the silane-functionalized carbon nanotubes, it would have been necessary and therefore obvious to look to the prior art for conventional silane coupling agents. Velasco-Santos provides this conventional teaching, showing that it was known in the reinforced composite art to form reinforced composites comprising a matrix and carbon nanotubes, wherein the nanotubes are functionalized with an organo-functionalized with a silane coupling agent chemically described as R-Si-R', wherein the R group is chosen to be reactive depending on the organic matrix used, which readily reacts with hydroxyl groups produced through oxidation on the nanotube surface (Velasco-Santos, pages 495-498). Velasco-Santos teaches that attaching the organo-functional groups to the nanotubes improves their chemical compatibility with specific polymers. It would

have been obvious to one of ordinary skill in the reinforced composite art at the time the invention was made to form the reinforced composite of the prior art, wherein the nanotubes comprise hydroxyl groups and are silane-functionalized as set forth in Velasco-Santos, motivated by the desire of forming a conventional reinforced composite with improved chemical compatibility when joining the nanotubes to the matrix. Additionally, as the prior art teaches that the R group is chosen to be reactive depending on the organic matrix used, it would have been obvious to one of ordinary skill in the reinforced composite art at the time the invention was made to choose a suitable R group to be reactive with an epoxy matrix, as the prior art suggests that it is within the level of ordinary skill to choose a suitable constituent to be reactive with an epoxy matrix, based on the desired compatibility of the materials and characteristics of the reinforced composites suitable for the intended application.

Regarding claim 69, the hydroxyl-functionalized carbon nanotubes are further silane functionalized with a silation reagent selected from at least silanol (Velasco-Santos, pages 495-498).

Regarding claims 68 and 69, although the prior art does not appear to teach the specifically claimed method of preparing the hydroxyl-functionalized carbon nanotubes, such a method of preparing is interpreted as a product-by-process limitation. Absent a showing to the contrary, it is Examiner's position that the article of the applied prior art is identical to or only slightly different than the claimed article. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is

Art Unit: 1786

unpatentable even though the prior product was made by a different process. *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985). The burden has been shifted to Applicant to show unobvious differences between the claimed product and the prior art product. *In re Marosi*, 218 USPQ 289 (Fed. Cir. 1983). The applied prior art either anticipated or strongly suggested the claimed subject matter. It is noted that if Applicant intends to rely on Examples in the specification or in a submitted declaration to show unobviousness, Applicant should clearly state how the Examples of the present invention are commensurate in scope with the claims and how the Comparative Examples are commensurate in scope with the applied prior art.

7. Claims 68 and 69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ton-That, as applied to claims 41, 42, 45, and 47 above, in view of Applicants' specification and "Chemical Functionalization of Carbon Nanotubes Through an Organosilane" to Velasco-Santos.

Regarding claims 68 and 69, the prior art appears to render obvious the claimed invention. Additionally, Applicants' specification teaches that prior art hydroxyl-functionalized carbon nanotubes include structures set forth in Figures 1 and 2 of Applicants' specification and set forth below:

Art Unit: 1786

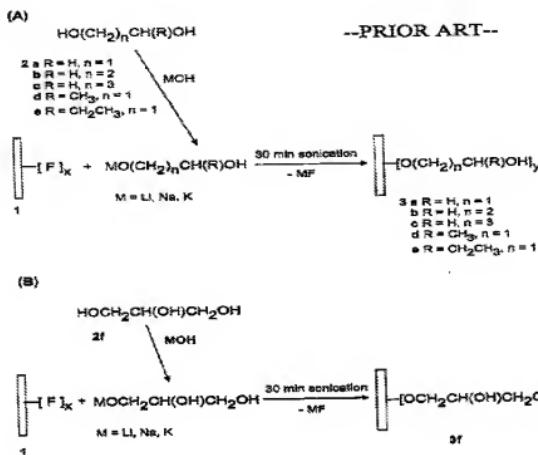


Fig. 1

--PRIOR ART--

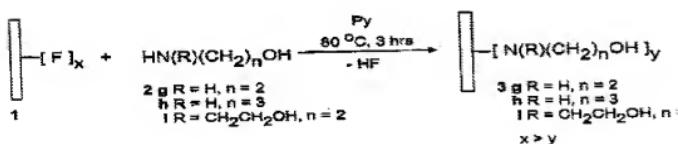


Fig. 2

Additionally, Velasco-Santos teaches that the silane coupling agent is chemically described as R-Si-R', wherein the R group is chosen to be reactive depending on the organic matrix used, which readily reacts with hydroxyl groups produced through oxidation on the nanotube surface (Velasco-Santos, pages 495-498). Velasco-Santos teaches that attaching the organo-functional groups to the nanotubes improves their chemical compatibility with specific polymers. It would have been obvious to one of ordinary skill in the reinforced composite art at the time the invention was made to form the reinforced composite of the prior art, wherein the nanotubes are comprise hydroxyl groups and are silane-functionalized as set forth in Velasco-Santos and wherein the carbon nanotubes are hydroxyl-functionalized as set forth in Applicants' specification, as Applicants' specification teaches that hydroxyl functionalized carbon nanotubes as set forth in Figures 1 and 2 of Applicants' specification were known, and motivated by the desire of forming a conventional reinforced composite with improved chemical compatibility when joining the nanotubes to the matrix. It should be noted that absent evidence to the contrary, the claimed structures would appear to result once the prior art combination is formed.

Regarding claims 68 and 69, although the prior art does not appear to teach the specifically claimed method of preparing the hydroxyl-functionalized carbon nanotubes, such a method of preparing is interpreted as a product-by-process limitation. Absent a showing to the contrary, it is Examiner's position that the article of the applied prior art is identical to or only slightly different than the claimed article. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is

unpatentable even though the prior product was made by a different process. *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985). The burden has been shifted to Applicant to show unobvious differences between the claimed product and the prior art product. *In re Marosi*, 218 USPQ 289 (Fed. Cir. 1983). The applied prior art either anticipated or strongly suggested the claimed subject matter. It is noted that if Applicant intends to rely on Examples in the specification or in a submitted declaration to show unobviousness, Applicant should clearly state how the Examples of the present invention are commensurate in scope with the claims and how the Comparative Examples are commensurate in scope with the applied prior art.

Response to Arguments

8. Applicants' arguments filed January 27, 2010, have been fully considered but they are not persuasive. Applicants argue that Ton-That does not teach, either expressly or inherently, or suggests a polymer composite in which carbon nanotubes chemically bind a fiber reinforcement material with the polymer. Examiner respectfully disagrees. The use of patents as references is not limited to what the patentees describe as their own inventions or to the problems with which they are concerned. They are part of the literature of the art, relevant for all they contain. A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill the art, including nonpreferred embodiments. MPEP 2123. Additionally, the claiming of a new use, new function or unknown property which is inherently present in the prior art does not necessarily make the claim patentable. There is no requirement that a person of ordinary skill in the art would have recognized the inherent disclosure at the time of invention, but only that the subject matter is in fact inherent in the prior art reference.

The reference teaches a composite comprising carbon nanotubes, a fiber reinforcement material, and a polymer (*see for example* Ton-That, paragraphs 0012-0022, 0078). Therefore, the reference appears to teach each of the structural components of the claimed composite. Additionally, since the prior art teaches a substantially similar structure and composition as the claimed invention, it is reasonable for one of ordinary skill in the art to expect that the components of the prior art would behave in a substantially similar manner as the claimed components, as at least independent claim 41 does not require additional components to yield the claimed invention. Additionally, the prior art teaches that the composite may be formed by, for example, melt blending or solution polymerization, wherein the nanotubes, fiber additives, and epoxy polymer are added into a polymer solution or polymer melt to form the nanocomposite (Id., paragraphs 0081-0083, 0088). It is reasonable for one of ordinary skill in the art to expect that the carbon nanotubes chemically bind the fiber additives with the polymer when forming the composite, at least to some degree, as the composite is bound together when formed in a solution or a melt and comprises a substantially similar structured as the claimed invention.

Applicants argue that Ton-That does not teach or suggest that the epoxy-functionalized graft polymer is bonded to the polymer matrix, and that the epoxy-functionalized graft polymer is bound to the nano-reinforcing material. Examiner respectfully disagrees. It should be noted that the claimed invention only requires a polymer chemically bound to the carbon nanotubes. The prior art teaches that the epoxy-functionalized graft polymer promotes interaction of the epoxy-functionalized graft polymer with the polymer matrix, thereby promoting interface interaction between the nano-material and the polymer matrix.

Applicants argue that Ajayan, Flatt and Phillips do not remedy the deficiencies of the prior art. Examiner respectfully disagrees. For the reasons set forth above, the prior art teaches and/or renders obvious the claimed invention.

Applicants argue that Velasco-Santos fails to remedy the deficiencies of the prior art. Examiner respectfully disagrees. For the reasons set forth above, the prior art teaches and/or renders obvious the claimed invention.

Applicants argue that Velasco-Santos does not teach or suggest the specific carbon nanotubes. Examiner respectfully disagrees. Velasco-Santos teaches hydroxyl-functionalized carbon nanotubes (*see for example* Velasco-Santos, page 496; Applicants' remarks of January 27, 2010, page 19). Although Applicants argue that one of ordinary skill in the art will recognize that the claimed hydroxyl-functionalized carbon nanotubes are different from those taught by Velasco-Santos and not obvious variants, it is well-settled that unsupported arguments are not a substitute for objective evidence. *In re Pearson*, 494 F.2d 1399, 1405, 181 USPQ 641, 646 (CCPA 1974). Applicants do not provide evidence of such differences. Additionally, as set forth above, the method of making the hydroxyl-functionalized carbon nanotubes is interpreted as a product by process limitation. Absent a showing to the contrary, it is Examiner's position that the article of the applied prior art is identical to or only slightly different than the claimed article. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir.

Art Unit: 1786

1985). The burden has been shifted to Applicant to show unobvious differences between the claimed product and the prior art product. *In re Marosi*, 218 USPQ 289 (Fed. Cir. 1983). The applied prior art either anticipated or strongly suggested the claimed subject matter. It is noted that if Applicant intends to rely on Examples in the specification or in a submitted declaration to show unobviousness, Applicant should clearly state how the Examples of the present invention are commensurate in scope with the claims and how the Comparative Examples are commensurate in scope with the applied prior art.

Conclusion

9. Applicants' amendment necessitated any new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicants are reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Art Unit: 1786

Any inquiry concerning this communication or earlier communications from the examiner should be directed to PETER Y. CHOI whose telephone number is (571)272-6730. The examiner can normally be reached on Monday - Friday, 08:00 - 15:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Larry Tarazano can be reached on (571) 272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Peter Y Choi/
Examiner, Art Unit 1786

/Andrew T Piziali/
Primary Examiner, Art Unit 1786